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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN STREET
CHICAGO, IL 60604

REPLY TO THE ATTENTION OF:
5HS-11

October 24, 1991

Mr. Kevin K. Wolka, P.E., Ph.D.
Geraghty & Miller, Inc.
50 W. Big Beaver Road, Suite 145
Troy, Michigan 48084

Dear Mr. Wolka:

The U.S. EPA is providing approval of Revision #4 (September 24, 1991) of the Phase II Hydrogeologic Investigation Workplan/ Sampling Plan/ Quality Assurance Project Plan (Phase II Workplan) for the Hi-Mill Manufacturing Company Site, Highland, Michigan.

Please note that to facilitate approval of the Phase II Workplan, the following changes were made (the bold print depicts the changes):

* 1. Pg. 5, Fourth full paragraph: The first sentence was changed and now reads: "Task 4 of the RI will include vertical profiling of the intermediate aquifer and field screening of groundwater samples with a field gas chromatograph, **as well as measurement of conductivity, pH, and temperature.**"

* 2. Pg. 6, Second full paragraph: The second sentence was changed and now reads: "A complete round of static water elevations **from all piezometers, staff gauges, and monitoring wells** will then be collected **quarterly for one year** to generate a potentiometric surface map for each flow system, confirm the existing flow directions, **and determine seasonal fluctuations in water levels.**"

* 3. Pg. 7, First full paragraph: The second sentence was changed and now reads: "Static water elevations will be collected from the piezometers on a quarterly schedule **for one year** to determine seasonal fluctuations in water levels."

* 4. Pg.11, Top of page: The first full sentence was changed and now reads: "The CLP laboratory results from samples collected from existing shallow monitoring well during well sampling activities **may** give an indication of the vertical extent **of** the VOC's."

* 5. Pg. 11, First full paragraph: The second sentence was

changed and now reads: "Due to the instrumentation utilized and the sample collection methodology, the analytical results may show a slight bias towards **underestimating** the actual VOC concentrations."

* 6. Pg. 16, Second full paragraph: The second sentence was changed and now reads: "The 10-inch ID casings will be installed using 12.0 inch ID hollow-stemmed augers and will extend from ground surface to **five feet into the first clay layer (or the thickness of the clay layer if less that five feet) which, in this case will be the blue clay." The remainder of page 16 beginning with the third full paragraph was deleted.**

* 7. Pg. 17: **The top of this page and the first full paragraph was deleted.**

* 8. Pg. 18, Second full paragraph: The first and second sentences were changed and now read: "If VOCs are detected by the gas chromatograph field screening **or if the conductivity, pH and/or temperature measurements indicate that the aquifer has been impacted**, a monitoring well will be constructed similar to the monitoring wells described in Section 2.6.3. The screen will be placed at the depth from which the sample that contained the highest concentration of VOCs was taken **or the depth at which the measured conductivity, pH, and/or temperature indicated impact."**

* 9. Pg. 18, Third full paragraph: The third sentence was changed and now reads: "If ground-water impacts are identified during the vertical profiling activities, the analytical results obtained from the GC **and the conductivity, pH and temperature measurements** will be reviewed to determine the optimal screen placement for the proposed monitoring well installations."

* 10. Pg. 20, Third paragraph: Information was added after the third sentence regarding the method to be used when plugging the borehole below the screen for IW-6: **" Void space creation shall be avoided when pulling back the auger. The portion of the soil boring below the screen will be plugged by allowing natural collapse of the borehole walls during auger pull back. The depth of open hole below the auger should be monitored continually to assure plugging of the hole. If natural collapse does not fill the hole**, then the portion of the soil boring below the screen will be plugged by backfilling with either untreated angular bentonite chips or a bentonite slurry. If a bentonite slurry is used, it will be placed into the boring using a tremie pipe. Approximately one foot of additional sand pack material will be placed between this backfill material and the bottom of the well screen to prevent the bentonite from reaching the screen."

* 11. Pg. 21, Second full paragraph: The second sentence was changed and now reads: "The double casing will consist of sufficient length of 10-inch ID, Schedule 80 PVC casing grouted in place **with a bentonite cement grout** to effectively seal off the shallow saturated zone from the intermediate aquifer.

* 12. Pg. 22: A paragraph was added between the first and second paragraphs which describes the method to be used when plugging the vertically profiled boreholes below the screen: **"If impact is detected in any of the vertically profiled boreholes, monitoring wells shall be installed with the screen placed at the depth from which the sample that contained the highest concentration of VOCs was taken or the depth at which the measured conductivity, pH, and/or temperature indicated impact. The portion of the soil boring below the screen will be plugged by backfilling with either untreated angular bentonite chips or a bentonite slurry. If a bentonite slurry is used, it will be placed into the boring using a tremie pipe. Approximately one foot of additional sand pack material will be placed between this backfill material and the bottom of the well screen to prevent the bentonite from reaching the screen."**

* 13. Pg. 22, Last paragraph: The first sentence was changed and now reads: "If constituents of concern are detected in **any** of the wells installed during Phase II, additional well installation may be necessary to determine the extent of the constituents of concern.

* 14. Pg 24, Last paragraph: The first sentence was changed and now reads: **"If the results from the gas chromatograph, conductivity, pH, and temperature** field screening of ground-water samples collected during the vertical profiling (VP-1, VP-2 and VP-3) of the intermediate aquifer **indicate that the aquifer has been impacted**, a monitoring well will be installed in the vertical profile boring from which the sample was taken."

A copy of these revised pages is attached to this correspondence for your use, and should be incorporated into the Phase II Workplan.

If you have any question, please feel free to contact me at (312) 886-5993.

Sincerely,

Karla L. Johnson
Remedial Project Manager

Attachment

cc: Debbie Larsen, MDNR
Murat Akyurek, Donohue

locations are concentrated on the west side of the Hi-Mill facility and in the area between Target Pond and Waterbury Lake. The increased areal coverage provided by the newly installed piezometers will allow Geraghty & Miller to better define the shallow flow system surrounding the Hi-Mill facility.

As discussed in the Technical Memorandum, four of the six staff gauges installed at the site have undergone intense weathering and are now unreadable. Therefore Geraghty & Miller is proposing to replace staff gauges SG-1, SG-2, SG-3 and SG-4 (Figure 2.0) to facilitate accurate readings during future monitoring activities.

Task 2 will entail collecting ground-water samples from hand augured boreholes and the piezometers installed in Task 1 in an effort to delineate the extent of the shallow ground-water impact potentially caused by former site operations. The ground-water samples collected will be analyzed by a portable gas chromatograph for the presence of volatile organic compounds. The study will analyze samples from the east and west side of the facility to determine if the existing shallow monitoring wells provide sufficient coverage to monitor impacted areas.

Four soil borings will be installed during Task 3 in areas surrounding the former solvent tanks (Figure 2.0) to supplement the data generated during the Phase I investigation. The analytical results obtained from the soil samples collected during the installation procedures will provide information on the horizontal and vertical extent of impacts.

Task 4 of the RI will include vertical profiling of the intermediate aquifer and field screening of groundwater samples with a field gas chromatograph, as well as measurement of conductivity, pH, and temperature. If contaminants are detected in any vertical profile borehole as a result of the groundwater field screening, a monitoring well will be constructed in that borehole.

The Technical Memorandum identified three distinct ground-water flow systems at the Hi-Mill site: a shallow perched flow system; an intermediate flow system; and a deep flow system. The vertical profiling activities outlined in Task 4 of the Phase II Work Plan will attempt to detect any impacts in the intermediate aquifer caused by former plant operations and identify the optimal screen placement for the intermediate monitoring wells installed

during Task 5 (Figure 2.0). At least two monitoring wells will be installed, additional wells will be installed if any constituents of concern are detected in a vertical profile borehole,

In order to expedite the project schedule and achieve maximum efficiency from personnel and equipment on-site, the vertical profiling borings and hand auger boring activities, described in Task 2 will proceed simultaneously. This will maximize the use of the on-site portable GC by utilizing it to screen ground-water samples collected from the hand-augured boreholes, the piezometers and vertical profile borings.

After the piezometers, staff gauges, and monitoring wells have been installed, a site survey (Task 6) will be performed to combine all data points to an identical government (USGS) datum. A complete round of static water elevations from all piezometers, staff gauges, and monitoring wells will then be collected quarterly for one year to generate a potentiometric surface map for each flow system, confirm the existing flow directions, and determine seasonal fluctuations in water levels.

A second round of ground-water sampling (Task 8) is scheduled at the site to confirm the nature and extent of impacted areas. Ground-water samples will be collected from each shallow, intermediate and deep monitoring well in an effort to determine the horizontal and vertical extent of contamination. After the field activities are complete, Geraghty & Miller and the USEPA will review the results of the Phase II study to evaluate whether additional work will be required.

To assure compliance with the project QAPP and adhere to the schedule outlined above, Geraghty & Miller will have at least two geologists on-site for the duration of the field work. The anticipated project schedule is presented in Appendix C.

2.1 Piezometer Installation

2.1.1 Purpose

Seventeen piezometers will be installed in designated areas surrounding the site to help delineate the flow regime of the shallow saturated zone. The purpose of installing the piezometers is to: 1) help determine the hydraulic connection between Target Pond and Waterbury Lake; 2) help determine if a westerly ground-water flow direction exists in the

shallow saturated zone; and 3) assist in determining if the bentonite seals in monitoring wells SW-12 and SW-15 are competent. The piezometers may also be used as data points during the plume delineation activities to obtain semi-quantitative GC analytical results. No quantitative samples will be collected from the piezometers.

2.1.2 Piezometer Locations

Figure 2.1 shows the approximate location of each piezometer. Static water elevations will be collected from the piezometer on a quarterly schedule for one year to determine seasonal fluctuations in water levels. Piezometer P1, P2 and P3 will be installed between Target Pond and Waterbury Lake. The static water elevations collected from these three piezometers will help determine the hydraulic connection between the two surface water bodies.

Piezometers P4, P5 and P6 will be installed in the area adjacent to monitoring wells SW-12 and SW-15. The static water elevations collected from these three piezometers will help indicate whether the exceptionally high static ground-water elevations observed in the two monitoring wells are representative of site conditions or whether the bentonite seals are incompetent. If the bentonite seals of Monitoring Wells SW-12 and SW-15 are found to be incompetent, the wells will either be replaced or abandoned. If the additional work proposed in the Phase II investigation indicates a shallow ground-water flow direction from the site towards the monitoring wells in question, the wells will be replaced. If the flow direction indicates shallow ground water flowing from the wells toward Target Pond, the monitoring wells will be abandoned after receiving EPA concurrence. Ground-water samples will be collected after the integrity of the seals are determined and wells replaced.

Piezometers P7 and P8 will be installed between the southwest corner of the Hi-Mill facility and the North Arm of Waterbury Lake. Static water elevations collected from these piezometers will confirm the potential gradient between the plant and the surface water body.

Piezometers P9, P10, P11, P12, P13, and P14 will be located on the west to north-west portion of the Hi-Mill property and on the adjacent state property. These piezometers will be used to confirm a possible westerly flow direction in the shallow saturated zone.

give an indication of the horizontal extent the VOC's. The CLP laboratory results from samples collected from the existing shallow monitoring wells during well sampling activities may give an indication of the vertical extent of the VOC's. In combining the analytical information from the two separate activities and comparing it to the interpreted ground-water flow direction of the shallow flow system, an assessment of whether the shallow monitoring well distribution is adequate to delineate the areas affected by VOC's can be made.

It should be noted that the analytical results of the GC survey will only be semi-quantitative. Due to the instrumentation utilized and the sample collection methodology, the analytical results may show a slight bias towards underestimating the actual VOC concentrations. Since the analytical results produced from the portable GC are intended to be for field screening purposes, no duplicate samples are scheduled for a certified CLP analysis.

2.3.2 Hand Auger Boring Locations

The activities to define the limits of the VOCs detected in ground water in the shallow perched water table will focus on the east and west side of the facility. Ground-water samples collected from the shallow monitoring wells on the east side of the plant (Figure 2.3.2) will act as the initial data points. Additional hand auger borings will then be installed in locations necessary to complete the definition of the extent of the VOC's. The analytical results of the ground-water samples collected from hand augured boreholes will be used to delineate the extent of VOC's.

2.3.3 Hand Auger Boring Installation

During the installation of the hand auger borings, Geraghty & Miller will collect ground-water samples from the shallow saturated zone beneath the site. Stainless steel hand augers equipped with a 3-inch inside diameter bucket auger will be utilized to install 3- to 5-foot deep boreholes. The depth of the borehole will be dependant upon the depth to the top of the perched water table. The borings will extend to at least 2 feet below the water table, unless at that depth the boring will penetrate the brown clay layer. Based on the high clay content of previous samples collected at the site, it is expected that the boreholes will remain open, allowing them to fill with ground water. A disposable polyethylene bottom filling bailer will

profiling activities due to its cost effective means for obtaining representative ground-water samples and its adaptability to hollow-stem auger drilling techniques. However, if sample collection problems are encountered with the Hydropunch II™ during field operations, an alternate profiling method may be utilized. The alternate profiling method selected will be approved by the USEPA prior to implementation.

The Hydropunch II™ is two inches in diameter and 55.5-inches long. It is constructed with a stainless steel barrel and a hardened carbon steel drive shoe. It is also equipped with a 5.25-inch, 120-mesh stainless steel screen. Additional construction details for the Hydropunch II are provided in Appendix D. The Hydropunch II sampling procedures are described below.

2.5.4 Vertical Profile Boring Installation

To minimize the potential of introducing surface contamination into the intermediate aquifer a 10-inch ID, Schedule 80 PVC casing will be installed at each of the three boring locations. The 10 inch ID casings will be installed using 12.0-inch ID hollow-stem augers and will extend from ground surface to five feet into the first clay layer (or the thickness of the clay layer if less than five feet) which, in this case, will be the blue clay. Each protective casing will be sealed in place with a bentonite cement grout. According to the boring logs and the geophysical logs developed in the previous investigation, the depth to the first significant clay layer varies at each location selected by the EPA. The logs also indicate that the depth to the top of the intermediate aquifer and its saturated thickness varies across the site.

To assure that the 10-inch ID, Schedule 80 PVC casings are seated in a competent, low permeability clay horizon, a split-spoon sample will be collected once the specified depths are reached. If the split spoon sample contains geologic materials consistent with low permeable clay identified in the logs the 10-inch ID casing will be installed and permanently grouted.

After allowing adequate time for the bentonite-cement grout to set, the cement plug will be broken and drilling activities will continue with 4.25-inch ID hollow stem augers. During the drilling activities, continuous split-spoon samples will be collected until the intermediate aquifer is encountered. According to the boring logs, the depth is expected to be approximately 40 feet bls at VP-1, 28.5 feet bls at VP-2, and 25 feet bls at VP-3. Once the top of the intermediate aquifer is identified, a pre-cleaned hydropunch will be attached to the drive rods and driven approximately 2.0 feet into the uppermost undisturbed horizon. The hydropunch will then be withdrawn approximately 18 inches. This retraction will expose the stainless steel screen and allow ground water to hydrostatically fill the hydropunch sample chamber with a representative water sample from an undisturbed horizon in the formation. During the hydropunch recovery, a ball (check) valve in the sampling device will close and allow the ground-water sample to be retrieved at the surface. This removal procedure will also disconnect the drive point, which will remain in the ground. After decanting the ground-water sample from the hydropunch, the sampling device will be disassembled and decontaminated prior to collecting the next sample. If sufficient head does not exist to fill a Hydro Punch II, a HydroPunch I™ or screened auger will be used to collect the ground-water sample.

After the first ground-water sample is collected and the HydroPunch removed from the center of the hollow-stem augers, the augers will be advanced to the approximate depth at which the ground-water sample was collected. A confirmatory geologic sample will then be

taken using a 2-ft split-spoon sampler. The HydroPunch will then be placed into the center of the hollow-stem augers, driven five feet deeper into the formation and a ground-water sample collected. The HydroPunch will be removed from the center of the hollow-stem augers and the augers will be advanced five feet. This will place the augers at the approximate depth at which the second ground-water sample was collected. The process of taking a confirmatory geologic sample and driving the HydroPunch another five feet and collecting a ground-water sample will then be repeated.

This procedure of collecting a confirmatory geologic sample, a ground-water sample and advancing the hollow-stem augers will continue at 5-ft intervals until the base of the intermediate aquifer is reached. Based upon the boring and gamma logs the anticipated thickness of the intermediate aquifer is 25 to 30 ft. Therefore five or six ground-water samples and confirmatory geologic samples will be collected from each vertical profile boring. After collecting the last sample and reaching the base of the intermediate aquifer, the MDNR will gamma log the borehole. The confirmatory geologic samples will be correlated to the gamma log.

If VOCs are detected by the gas chromatograph field screening or if the conductivity, pH and/or temperature measurements indicate that the aquifer has been impacted, a monitoring well will be constructed similar to the monitoring wells described in Section 2.6.3. The screen will be placed at the depth from which the sample that contained the highest concentration of VOCs was taken or the depth at which the measured conductivity, pH, and/or temperature indicated impact. If VOCs are not detected, the boring will be abandoned by plugging with bentonite cement grout pumped down the borehole using a tremmie pipe.

All ground-water samples collected during the vertical profiling activities will be analyzed using the on-site portable GC for VOCs according to the methodologies outlined in Section 2.3.4 of this Work Plan. The samples will also be checked for pH, temperature, and conductivity. If ground-water impacts are identified during the vertical profiling activities, the analytical results obtained from the GC and the conductivity, pH and temperature measurements will be reviewed to determine the optimal screen placement for the proposed monitoring well installations.

2.6.3 Monitoring Well Construction

Both monitoring wells installed will be constructed with a 5-foot, 0.01-inch slot, continuous strand, wire wrap, 304 stainless steel screen. The intermediate wells will be constructed with 10-inch ID, Schedule 80, PVC surface casing to minimize the possibility of cross contaminating the intermediate aquifer. Boreholes for both monitoring wells will be advanced using hollow stem augers (HSA).

2.6.4 Monitoring Well Installation

Boreholes for each monitoring well will be initially advanced using 12.25 inch hollow stem augers. Soil samples will be collected continuously using a CME continuous 5-foot split-spoon sampling device. Non-beveled steel liners will be utilized in the continuous sampler to reduce disturbance. If the unconsolidated deposits are not conducive to recovering 5-ft cores, the drill rig will be converted to perform sample collection with 2-ft stainless steel split spoons. The 2-ft split spoon will be driven and continuous samples collected in accordance with ASTM Method D1586-84, "Standard Method for Penetration Test and Split-Barrel Sampling of Soils".

The July 25, 1991, EPA dispute resolution ruling specified that one of the monitoring wells (IW-6) should be installed in the intermediate aquifer with its well screen set at a depth equal to 2/3's of the thickness of the aquifer. Therefore this soil boring will continue until the lower confining layer of the intermediate aquifer is reached. The depth of the screened interval will then be calculated from the actual measurements of the aquifer thickness. Void space creation shall be avoided when pulling back the auger. The portion of the soil boring below the screen will be plugged by allowing natural collapse of the borehole walls during auger pull back. The depth of open hole below the auger should be monitored continually to assure plugging of the hole. If natural collapse does not fill the hole, then the portion of the soil boring below the screen will be plugged back by backfilling with either untreated angular bentonite chips or a bentonite slurry. If a bentonite slurry is used, it will be placed into the boring using a tremie pipe. Approximately one foot of additional sand pack material will be placed between this backfill material and the bottom of the well screen to prevent the bentonite from reaching the screen.

The second monitoring well (IW-7) is also planned to be installed downgradient of the site, off the Hi-Mill property (Figure 2.1). Construction of monitoring well IW-7 will be similar to that of IW-6. Both wells will be constructed with a 2-inch diameter, 5-foot stainless

steel screen and a PVC riser. Based on information obtained from the boring logs of Monitoring Wells SW-1 and SW-2, and the gamma log of the abandoned production well on the south side of the facility, it is likely that the proposed Monitoring Well IW-7 could be installed in an geologic setting which contrasts that of the east side of the facility. Geraghty & Miller suspects that there might be a saturated sand seam present within the brown clay that is unrelated to the shallow or intermediate flow systems previously defined by Techna. The additional geophysical activities proposed to be implemented by the MDNR should help delineate this horizon, if it exists.

If a saturated sand seam is encountered at a depth similar to the screened elevation (12 to 17 feet below grade) of monitoring well SW-1, it is anticipated that IW-7 would be installed as a shallow monitoring well. The field decision on whether a shallow monitoring well is set will be based on the discretion of the on-site geologist, the associated HNU readings, the portable GC analytical results, gamma logging and the concurrence of the USEPA representative. If the on-site geologist and the EPA representative feel the saturated unit is of sufficient water bearing capacity or the saturated horizon shows any indications of VOC contamination, Monitoring Well IW-7 will be set in the shallow saturated zone.

If a saturated sand seam is not encountered, the 2.25-inch augers will be advanced an additional 5 feet to ensure that significant sand seams are not detected and that the augers are seated in a clayey formation suitable for double casing. The double casing will consist of sufficient length of 10-inch ID, Schedule 80 PVC casing grouted in place with a bentonite cement grout to effectively seal off the shallow saturated zone from the intermediate aquifer. After adequate curing time, drilling will continue with 4.25-inch ID augers until the depth of the interval that is to be screened is reached. A monitoring well will then be constructed.

The sand pack will extend from approximately 0.5 ft. below the screen to 2 ft. above the screen. 1 ft. to 2 ft. of untreated bentonite pellets will be placed above the sand pack. If the depth of standing water above the sand pack is greater than approximately 15 ft, 1 ft to 2 ft of fine sand will be substituted for the bentonite pellets. The reason for this is the bentonite pellets may swell and bridge over in the annular space between the riser and formation before reaching the top of the sand pack. The fine sand will serve the same purpose; to keep the bentonite grout that will be placed above it from reaching the sand pack.

Once the sand pack and bentonite pellets (or fine sand) are installed, a bentonite grout will be pumped down the borehole through a tremie pipe. Grout will continue to be pumped through the 4.25-inch augers as the augers are retrieved. After the 4.25-inch augers are removed, additional quantities of grout will be pumped between the 10-inch ID PVC casing and the monitoring well riser pipe. Well completion procedures for the monitoring wells completed in the Phase II investigation will be identical to those outlined by Techna in Section 2.5.2 of Techna's Hi-Mill Manufacturing Company Remedial Investigation Feasibility Work Plan, Site Safety Plan, Quality Assurance Project Plan. (October 26, 1989).

If impact is detected in any of the vertically profiled boreholes, monitoring wells shall be installed with the screen placed at the depth from which the sample that contained the highest concentration of VOCs was taken or the depth at which measured conductivity, pH, and/or temperature indicated impact. The portion of the soil boring below the screen will be plugged by backfilling with either untreated angular bentonite chips or a bentonite slurry. If a bentonite slurry is used, it will be placed into the boring using a tremie pipe. Approximately one foot of additional sand pack material will be placed between this backfill material and the bottom of the well screen to prevent the bentonite from reaching the screen.

During any portion of the investigation where the drill rig must occupy part of the highway, traffic control measures which comply with the Michigan Department of Transportation (MDOT) specifications will be initiated.

2.6.5 Monitoring Well Soil Sampling

To ensure that any existing sand seams are identified by the on-site geologist, the borehole for each monitoring well will be continuously sampled using a CME, continuous five-foot, stainless steel, split-spoon sampler. With the high clay content of the underlying soils, the 5-ft split-spoon sampler will recover superior samples and should provide superior geologic correlation efforts in the RI report. All soil sample cores will be screened for volatile organic compounds (VOCs) using a portable photoionization detector (HNU). It is anticipated that the two soil samples with the highest HNU reading from each borehole will be submitted to the selected laboratory for VOC and metals analysis. It is also anticipated that a sample of the brown clay horizon from each hole will be submitted to the Materials and Testing Company of Grand Rapids for a falling head permeability analysis and a soil classification analysis according to the Unified Soil Classification System. Soil samples being submitted for a CLP VOC and metals analysis will be transferred from the split spoon directly into the appropriate sample container provided by the laboratory. All other sample collection methodologies will be performed according to Section 2.4.5 of Techna's Site Sample Plan.

If constituents of concern are detected in the ground-water in any of the wells installed during Phase II, additional well installation may be necessary to determine the extent of the constituents of concern. All additional work would be subject to approval by the USEPA. If

proposed eliminating them from the analytical suite of Phase II. The first round of sampling also indicated that nitrogen compound levels in the ground water should not be a concern; therefore, analyses for nitrates, nitrites, and ammonia nitrogen are not being included. The scheduled analysis for the Phase II investigation is now limited to the parameters of concern at the site: metals and VOCs.

Due to the former plant processes and associated disposal practices, the shallow soils and ground water pose the greatest potential for contamination and routes of migration (Figure 2.7-1). It is therefore recommended that all the shallow monitoring wells be sampled for both metals and VOCs. The Phase II results of the metals and VOC analyses will help confirm the impacts detected in the Phase I sampling event.

Constituents of concern were not detected in any of the Phase I laboratory analysis for the intermediate wells and according to the geologic interpretation presented in the Hi-Mill Technical Memorandum, the only documented migration pathway for the constituents of concern is by seepage through Target Pond. Based on the up-gradient location of wells, IW-5, SW-17, SW-18, and SW-19, the relatively long migration pathway from the source, and the thickness of the underlying clay layer, it is very unlikely that metals or VOCs from the Hi-Mill facility would be present in those up-gradient wells. However, at the request of the MDNR, all four of those wells will be sampled for metals. Monitoring well IW-5 will also be sampled for VOCs.

Intermediate wells IW-1, IW-2, IW-3 and IW-4 are located downgradient from Hi-Mill or located in areas underlying surficial contamination. It is therefore recommended that these wells be sampled for both metals and VOCs. The two or more additional wells installed west of the facility during Phase II activities will also be sampled for metals and VOCs.

If the results from the gas chromatograph, conductivity, pH, and temperature field screening of ground-water samples collected during the vertical profiling (VP-1, VP-2 and VP-3) of the intermediate aquifer indicate that the aquifer has been impacted, a monitoring well will be installed in the vertical profile boring from which the sample was taken. Any monitoring wells installed in a vertical profile borehole will be sampled for VOCs and the short list of dissolved metals.